DOCUMENT RESUME

ED 325 380 SE 051 720

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TITLE The Idea of Order at Geometry Class.
PUB DATE 90
NOTE 6p.
PUB TYPE Viewpoints (120)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Architecture; Art; *College Mathematics; Course Descriptions; Experiential Learning; *Geometry; Higher Education; *Interdisciplinary Approach; Literature; Mathematics Education; *Philosophy; *Undergraduate Study

ABSTRACT

The idea of order in geometry is explored using the experience of assignments given to undergraduates in a college geometry course "From Space to Geometry." Discussed are the definition of geometry, and earth measurement using architecture, art, and common experience. This discussion concludes with a consideration of the question of whether geometry is "something out there" or "something in us." (CW)

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THE IDEA OF ORDER AT GEOMETRY CLASS

Thomas Rishel

For three years now I have been teaching a mathematics course of my own design called From Space to Geometry, in which we try to investigate the myriad ways in which human beings use geometry in daily life. Since the course is designed for people who have "only" an intuitive understanding of what geometry might be, it is necessary for me to have available a large list of writing projects which can be used to develop geometric intuition. I will describe here only one unit, comprising about three weeks of the syllabus, from the course as it has evolved over the three years. Before I describe this unit, however, I need, for reasons you will understand shortly, to tell you briefly how the course begins.

We start the semester with my asking for a definition of the word "geometry." Usually we arrive at the working definition "earth-measurement." My first assignment then has the students measure the height of a tall tower on campus. In the ensuing discussion, the students find that they have used methods and ideas, such as similar triangles or the Pythagorean theorem, that do not hold on the surface of the Earth. So again I ask, "What is the definition of geometry?"

About three weeks into the semester I give an assignment:

> Go to a place you like. Sit there and describe it.
> Compare it to a place you don't like.
> Now look at the words you have used in describing your

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> places. How many of those words have to do with geometry, in some sense or another? What do you think geometry may have to do with your liking or disliking these places?

Students then come back to class to discuss the places they have chosen. I don't require that they read their papers, but I do encourage them to tell the class what places they have chosen and why; then, when they are obviously using their writing as an memory aid, I tell them to "go ahead and read to us" what they have written. As they speak, I often write down on the board individual words and phrases that they have used which are somehow "geometric." Some of these words are those we obviously think of in such a context, such as:

Large, small, open, closed, planar, square, angular.

Another set of words, while still being "geometric," starts to edge toward metaphor:

Regular, even, ordered, balanced, proportional, shapeless.

Still other words, describing motion, are geometric in a different sense:

Smooth, graceful, easy access, flowing, no movement.

When a sufficient number of words has been collected, I point out how each set of them has led the writer to another set of words and phrases, supposedly nongeometric, as when "large and open" leads the writer to "a sense of freedom and independence," or "closed in" brings on "a white and gray room with no space," as well as "suffocating" and "confining." We note that some geometric cues can lead to conflicting thoughts, as when "clutter" brings on "confusion," while "clutter that is mine" triggers the phrases "comforting" and "makes me feel at home." "Regularity" can bring on "clarity," but also "monotonity."

I could continue with other examples of the above, but there are

other points I want to get to, so I will finish with one more example of how geometric words conjure up emotions. This semester, one of my football players described how a particular structure was "not lined up properly," and that fact "angers me." When I challenged him as to whether it was really anger that he felt, he replied, after a pause, "Yeah. You know. It shouldn't be that way."

Our discussion often ranges as much as two or three hours, and touches on questions of architecture, design, art, safety, and the like. Once we have a vocabulary in place, and see that geometric words can be metaphors, we are ready to carry the assignment further.

My next assignment to the students is:

> Go to the local art museum. Choose a work or set of works, which may be in any medium you choose. Evaluate the works using the geometric vocabulary that we have previously constructed, along with other geometric words that may apply to the art, such as "dimension" or "perspective."

By now the students have some idea of what such an assignment is about. They happily use and understand phrases such as "the way the sculpture arranges and modifies the space around it," or "the artist's 'trick' of leading our eye to the darkest, center area of the canvas, where the darkness leads us back out to the edges again." We can discuss "vanishing points and lines," and what these have to do with the study of projective geometry. We also see how the use of light and shadow can lead the eye through a canvas to attach itself to a focal point.

One of my favorite quotes from this semester is from a woman who said "I don't see much geometry in this work. It's just a small octagonal pot with a textured glaze that gives it a feeling of depth."

My next assignment in this unit may or may not surprise you, depending on how you have interpreted the talk thus far.

I give the students a poem, "the Idea of Order at Key West" by Wallace Stevens, the one that begins "She sang beyond the genius of the sea." The assignment asks the students to read the poem through twice. After the second reading, they are to underline any geometric words they find, especially concentrating on the penultimate stanza:

> Ramon Fernandez, tell me, if you know,
> Why, when the singing ended and we turned
> Toward the town, tell why the glassy lights,
> The lights in the fishing boats at anchor there,
> As the night descended, tilting in the air,
> Mastered the night and portioned out the sea,
> Fixing emblazoned zones and fiery poles,
> Arranging, deepening, enchanting night.

We then draw a picture, based on the geometric words we have chosen, of where the "we" of the poem are during this stanza, and what it is we are seeing; namely, the lights on the fishing boats reflecting in the water are sending "emblazoned" latitude lines through that water toward us. We discuss how this picture looks very much like the one of the Earth we drew so often when we were comparing Earth geometry to the geometry that makes similar triangles and Pythagoras work. Then we discuss what this picture might have to do with the poem's final stanza:

> Oh! Blessed rage for order, pale Ramon,
> The maker's rage to order words of the sea,
> Words of the fragrant portals, dimly-starred,
> And of ourselves and of our origins,
> In ghostlier demarkations, keener sounds.

We discuss the word "order," and where that order may come from, and who the "maker" might be in this stanza.

We discuss what all this might have to do with geometry, and whether the "geometry" we talk about is "something out there" or

"something in us."

We compare our making a geometry which fits the Earth with the "arranging the night" of the "maker."

And finally, we ask where the "ghostlier demarkations" can be, and whether we can ever get to them.

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Delivered to CCCC Convention,
Chicago, March, 1990.